DOCUMENT-IDENTIFIER: US 6046072 A
TITLE: Process for fabricating a crack resistant resin
encapsulated
semiconductor chip package

---------- KWIC ---------

ASZZ:
<u>Hitachi</u> Chemical Company, Ltd.

ABPL:
A heat-resistant adhesive is provided for use in an
adhesive member for the
fabrication of a semiconductor package by bonding a
semiconductor chip to a
lead frame with the adhesive member and sealing at least
the semiconductor chip
and a bonded part between the semiconductor chip and the
lead frame with a
sealant. The adhesive has a coming-out length of not more
than 2 mm and a
<u>water absorption</u> rate of not more than 3 wt. %. Preferably,
the adhesive has a
glass transition point of at least 200.degree. C.

BSPR:
(a) a heat-resistant adhesive suitable for use in an
adhesive member for the
fabrication of a semiconductor package by bonding a
semiconductor chip to a
lead frame with the adhesive member and molding at least
the semiconductor chip
and the bonded part between the semiconductor chip and the
lead frame with a
molding compound, in which the heat resistant adhesive has
a coming-out-length
of not more than 2 mm and a <u>water absorption</u> rate of not
more than 3 wt. %,

BSPR:
(b) a heat-resistant adhesive suitable for use in an
adhesive member for the
fabrication of a semiconductor package by bonding a
semiconductor chip to a
lead frame with the adhesive member and molding at least

the semiconductor chip
and the bonded part between the semiconductor chip and the lead frame with a
molding compound, in which the heat-resistant adhesive has a coming-out length
of not more than 2 mm, a **water absorption** rate of not more than 3 wt. % and a
glass transition temperature of at least 200.degree. C.,

BSPR:
The term "**water absorption** rate" used herein means a **water absorption** rate
obtained from a change in weight of an adhesive before and after immersion in
water. Here, a film of the adhesive having a size of 5 cm.times.5 cm with a
thickness of 25 .mu.m is used as a testing object and, after dried at
100.degree. C. for 1 hour, it is immersed in water at 23.degree. C. for 24
hours to measure the water absoprtion.

DEPR:
No particular limitation is imposed on the specific heat-resistant adhesive
employed in the present invention insofar as its **water absorption** rate and
coming-out length are not more than 3 wt. % and not more than 2 mm. Among
preferred heat-resistant adhesives are those with a principal constituent of
thermoplastic resin, preferably having a glass transition temperature of at
least 200.degree. C. For these reasons, a polyimide adhesive or a polyamide
adhesive is preferred.

DEPR:
The **water absorption** rate of the heat-resistant adhesive according to the
present invention is 3 wt. % or less, preferably 2.5 wt. % or less, more
preferably 2.0 wt. % or less. Its coming-out length is 2 mm or less,
preferably 1 mm or less, more preferably 0.5 mm or less. In particular, the
heat-resistant adhesive according to the present invention desirably has, in

addition to the properties described above, a glass transition temperature of
at least 200.degree. C., preferably 225.degree. C. or higher, more preferably
250.degree. C. or higher.

DEPR:
Where the glass transition temperature is lower than 250.degree. C. or the
coming-out length is greater than 1 mm in the present invention, the **water**
absorption rate is preferably not more than 3 wt. %, in particular, 1.5 wt. %.
The thinner the sealing material is or the higher the percentage of the
occupation of the adhesive in a package is, the more preferable it is to have a
shorter coming-out length.

DEPR:
Amide groups may mount to 10-90 mole %, preferably 20-70 mole %, more
preferably 30-50 mole % of the sum of imide groups and amide groups.
Percentages smaller than 10 mole % lead to small adhesion but percentages
greater than 90 mole % result in a large **water absorption** rate.

DEPR:
The heat-resistant adhesive according to the present invention can be
synthesized principally from (A) a diamine or (A') a diisocyanate and (B) an
acid anhydride and/or (C) a dicarboxylic acid or an amide-forming derivative
thereof. The heat-resistant adhesive can be easily produced by combining the
above reactants and also adjusting their reaction ratio, reaction conditions
and molecular weight, optionally adding additives while selecting their types
and optionally adding an additional resin such as an epoxy resin in such a way
that the resulting heat-resistant adhesive has the prescribed properties
described above, namely, a coming-out length of not more than 2 mm a **water**

absorption rate of not more than 3 wt. % and preferably a glass transition
temperature of at least 200.degree. C.

DEPR:
In this case, it has been found that even if a heat-resistant adhesive has Tg
lower than 200.degree. C., mixing of an additional resin such as an epoxy
resin and one or more of the below-described additives, such as a coupling
agent, make it possible to adjust its **water absorption** rate and coming-out
length within the respective ranges specified in the present invention.

DEPR:
No particular limitation is imposed on the epoxy resin which can be mixed with
a specific heat-resistant polyimide adhesive of the present invention, in so
far as it has at least 2 epoxy groups on average per molecule. Examples of
such an epoxy resin include the **glycidyl ether** of bisphenol A, the **glycidyl**
ether of bisphenol F, phenolnovolak type epoxy resins, polyglycidyl esters of
polyhydric alcohols, polyglycidyl esters of polybasic acids, alicylic epoxy
resins and hydantoin epoxy resins.

DEPR:
When the heat-resistant adhesive according to the present invention is used as
a composite adhesive sheet by coating it on a base film (or sheet), the
composite adhesive sheet can be obtained by coating a heat-resistant adhesive
having a **water absorption** rate of not more than 3 wt. % and a coming-out length
of not more than 2 mm and, preferably, a glass transition temperature of at
least 200.degree. C. or a varnish thereof on both surfaces of a heat-resistant
film, preferably a surface-treated heat-resistant film.

DEPR:
The heat-resistant film has a glass transition temperature

(Tg) which is higher
than that (Tg) of the heat-resistant adhesive according to
the present
invention and is preferably at least 200.degree. C., more
preferably
250.degree. C. or higher. The heat-resistant film has a
water absorption rate
of not more than 3 wt. %, preferably 2 wt. % or lower.

DEPR:
Accordingly, the heat-resistant film employed in this
invention may preferably
be a polyimide film in view of Tg, **water absorption** rate
and coefficient of
thermal expansion. Particularly preferred is a film
equipped with the physical
properties that the Tg is at least 250.degree. C., the
water absorption rate
is 2 wt. % or less and a coefficient of thermal expansion
of 3.times.10.sup.-5
/.degree. C. or lower.

DEPR:
The film was immersed in water of 25.degree. C. for 24
hours. As a result, it
was found to have a **water absorption** rate of 0.3 wt. %.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 1.21 dl/g,
Tg of 268.degree. C., a thermal decomposition point of
410.degree. C., a
water absorption rate of 0.7 wt. % and a coming-out length
of 0.01 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.48 dl/g,
Tg of 300.degree. C., a thermal decomposition temperature
of 405.degree. C.,
a **water absorption** rate of 1.0 wt. % and a coming-out
length of 0.5 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.61 dl/g,
Tg of 275.degree. C., a thermal decomposition temperature
of 415.degree. C.,

a **water absorption** rate of 0.5 wt. % and a coming-out
length of 1.5 mm..

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.62 dl/g,
Tg of 255.degree. C., a thermal decomposition temperature
of 440.degree. C.,
and a **water absorption** rate of 1.2 wt. % and a coming-out
length of 0.2 mm.

DEPR:
The polyamide so obtained was found to have a reduced
viscosity of 0.45 dl/g,
Tg of 219.degree. C., a thermal decomposition temperature
of 425.degree. C.,
a **water absorption** rate of 2.3 wt. % and a coming-out
length of 2.4 mm.

DEPR:
The composite film was found to have Tg of 255.degree. C.,
a **water absorption**
rate of 0.6 wt. % and a coming-out length of 1.5 mm.

DEPR:
In 20 g of DMF, 1.74 g (7 mmole) g of
4,4'-diaminodiphenylsulfone (DDS) and
1.23 g (3 mmole) of BAPP were dissolved, followed by the
addition of 2.02 g (20
mmole) of triethylamine. While being cooled below
5.degree. C., the resulting
solution was added with 2.03 g (10 mmole) of isophthaloyl
chloride in portions.
They were reacted for 5 hours below 5.degree. C. As in
Example 1, a polyamide
was obtained in the form of powder. The polyamide so
obtained was found to
have a reduced viscosity of 0.88 dl/g, Tg of 260.degree.
C., a thermal
decomposition temperature of 435.degree. C., a **water
absorption** rate of 2.5
wt. % and a coming-out length of 0.2 mm.

DEPR:
The composite film was found to have Tg of 260.degree. C.,
a **water absorption**
rate of 1.1 wt. % and a coming-out length of 0.5 mm.

DEPR:
The polyamide-imide so obtained was found to have a reduced viscosity of 1.15
dl/g, Tg of 258.degree. C., a thermal decomposition temperature of 385.degree.
C., a **water absorption** rate of 1.0 wt. % and a coming-out length of 0.02 mm.

DEPR:
In a similar manner to Example 1 except that 5.76 g (10 mmole) of BABT, 2.74 g
(7.5 mmole) of IPDDM, 0.41 g (1.0 mmole) of BAPP and 1.26 g (1.5 mmole) of
"X-22-161AS" were used instead, a polyimide was obtained in the form of powder.
The polyimide so obtained was found to have a reduced viscosity of 0.65 dl/g,
Tg of 226.degree. C., a thermal decomposition temperature of 396.degree. C.,
a **water absorption** rate of 0.3 wt. % and a coming-out length of 1.7 mm.

DEPR:
The polyimide so obtained was found to have a reduced viscosity of 0.87 dl/g,
Tg of 270.degree. C., a thermal decomposition temperature of 520.degree. C.,
a **water absorption** rate of 2.3 wt. % and a coming-out length of 0.01 mm.

DEPR:
The polyamide-imide so obtained was found to have a reduced viscosity of 0.57
dl/g, Tg of 185.degree. C., a thermal decomposition temperature of 420.degree.
C., a **water absorption** rate of 0.13 wt. % and a coming-out length of 0.8 mm.

DEPR:
A varnish which had been obtained by dissolving 100 g of the polyamide-imide
powder and 3 g of .gamma.-glycidoxypropyltrimethoxysilane in 400 g of DMF was
coated on one surface of a polyimide film ("UPILEX S", trade name), followed by
drying at 100.degree. C. for 10 minutes. The other surface of the polyimide
film was also coated with the varnish similarly, followed

by drying at
250.degree. C. for 10 minutes, whereby a composite sheet was obtained. The
composite sheet so obtained was found to have an adhesive strength of 1.6 kN/m
with a 42 alloy sheet. The adhesive layers were found to have Tg of
185.degree. C., a **water absorption** rate of 1.3 wt. % and a coming-out length
of 0.2 mm.

DEPR:
The polyimide so obtained was found to have a reduced viscosity of 0.65 dl/g,
Tg of 170.degree. C., a thermal decomposition temperature of 390.degree. C.,
a **water absorption** rate of 1.0 wt. % and a coming-out length of 1.8 mm.

DEPR:
Using a varnish obtained by dissolving 100 g of the polyimide powder and 5 g of
.gamma.-glycidoxypropyl-methyldiethoxysilane in 400 g of DMF, a composite sheet
was obtained as in Example 13. The composite sheet had an adhesive strength of
1.3 kN/m with a 42 alloy sheet. In addition, the adhesive layers were found to
have Tg of 172.degree. C., a **water absorption** rate of 1.0 wt. % and a
coming-out length of 1.8 mm.

DEPR:
The polyamide-imide so obtained was found to have a reduced viscosity of 0.85
dl/g, Tg of 190.degree. C., a thermal decomposition temperature of 395.degree.
C., a **water absorption** rate of 0.1 wt. % and a coming-out length of 0.6 mm.

DEPR:
A varnish obtained by dissolving 100 g of the polyamide-imide powder and 10 g
of .gamma.-glycidoxypropyl-methyldiethoxysilane in 400 g of NMP was coated on
both surfaces of a polyimide film ("UPILEX S", trade name). The varnish so
coated was dried at 100.degree. C. for 10 minutes and then

at 275.degree. C.
for 10 minutes, whereby a composite sheet was obtained.
The composite sheet
was found to have an adhesive strength of 1.4 kN/m with a
42 alloy sheet. In
addition, the adhesive layers were found to have Tg of
191.degree. C., a **water**
absorption rate of 1.1 wt. % and a coming-out length of 0.2
mm.

DEPR:
The polyamide so obtained was found to have a reduced
viscosity of 0.45 dl/g,
Tg of 280.degree. C., a thermal decomposition temperature
of 430.degree. C.,
a **water absorption** rate of 3.5 wt. % and a coming-out
length of 1.2 mm.

DEPR:
In a similar manner to Example 4, polyimide powder having a
reduced viscosity
of 0.35 dl/g was obtained. The polyimide so obtained was
found to have Tg of
275.degree. C., a thermal decomposition temperature of
410.degree. C., a
water absorption rate of 0.6 wt. % and a coming-out length
of 3.4 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.44 dl/g,
Tg of 187.degree. C., a thermal decomposition temperature
of 465.degree. C.,
a **water absorption** rate of 1.1 wt. % and a coming-out
length of 2.2 mm.

CLPR:
14. A method of selecting an adhesive for fabrication of a
semiconductor
package by bonding a semiconductor chip to lead frames,
comprising measuring
the coming-out length of an adhesive and a step of
selecting an adhesive whose
coming-out length is not longer than 2 mm and whose **water**
absorption rate is
not higher than 3% by weight,

CLPV:

said adhesive member is make of polyimide or polyamide and includes a
heat-resistant adhesive having a coming-out length of not more than 2 mm and a
water absorption rate of not more than 3 wt %,

CLPV:
wherein said **water absorption** rate is measured by steps of:

CLPW:
calculating the **water absorption** rate of the adhesive from the weight
difference of the film before and after being soaked in water.

DOCUMENT-IDENTIFIER: US 6248613 B1
TITLE: Process for fabricating a crack resistant resin
encapsulated
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ASZZ:
Hitachi Chemical Company, Ltd.

ABPL:
A heat-resistant adhesive is provided for use in an
adhesive member for the
fabrication of a semiconductor package by bonding a
semiconductor chip to a
lead frame with the adhesive member and sealing at least
the semiconductor chip
and a bonded part between the semiconductor chip and the
lead frame with a
sealant. The adhesive has a coming-out length of not more
than 2 mm and a
water absorption rate of not more than 3 wt. %. Preferably,
the adhesive has a
glass transition point of at least 200.degree. C.

BSPR:
The term **"water absorption** rate" used herein means a **water
absorption** rate
obtained from a change in weight of an adhesive before and
after immersion in
water. Here, a film of the adhesive having a size of 5
cm.times.5 cm with a
thickness of 25 .mu.m is used as a testing object and,
after dried at
100.degree. C. for 1 hour, it is immersed in water at
23.degree. C. for 24
hours to measure the water absoprtion.

BSPV:
(a) a heat-resistant adhesive suitable for use in an
adhesive member for the
fabrication of a semiconductor package by bonding a
semiconductor chip to a
lead frame with the adhesive member and molding at least
the semiconductor chip

and the bonded part between the semiconductor chip and the lead frame with a
molding compound, in which the heat-resistant adhesive has a coming-out-length
of not more than 2 mm and a **water absorption** rate of not more than 3 wt. %,

BSPV:
(b) a heat-resistant adhesive suitable for use in an adhesive member for the
fabrication of a semiconductor package by bonding a semiconductor chip to a
lead frame with the adhesive member and molding at least the semiconductor chip
and the bonded part between the semiconductor chip and the lead frame with a
molding compound, in which the heat-resistant adhesive has a coming-out length
of not more than 2 mm, a **water absorption** rate of not more than 3 wt. % and a
glass transition temperature of at least 200.degree. C.,

DEPR:
No particular limitation is imposed on the specific heat-resistant adhesive
employed in the present invention insofar as its **water absorption** rate and
coming-out length are not more than 3 wt. % and not more than 2 mm. Among
preferred heat-resistant adhesives are those with a principal constituent of a
heat-resistant thermoplastic resin, preferably having a glass transition
temperature of at least 200.degree. C. For these reasons, a polyimide adhesive
or a polyamide adhesive is preferred.

DEPR:
The **water absorption** rate of the heat-resistant adhesive according to the
present invention is 3 wt. % or less, preferably 2.5 wt. % or less, more
preferably 2.0 wt. % or less. Its coming-out length is 2 mm or less,
preferably 1 mm or less, more preferably 0.5 mm or less. In particular, the
heat-resistant adhesive according to the present invention desirably has, in

addition to the properties described above, a glass transition temperature of
east 200.degree. C., preferably 225.degree. C. or higher, more preferably
250.degree. C. or higher.

DEPR:
Where the glass transition temperature is lower than 250.degree. C. or the
coming-out length is greater than 1 mm in the present invention, the **water**
absorption rate is preferably not more than 3 wt. %, in particular, 1.5 wt. %.
The thinner the sealing material is or the higher the percentage of the
occupation of the adhesive in a package is, the more preferable it is to have a
shorter coming-out length.

DEPR:
Amide groups may mount to 10-90 mole %, preferably 20-70 mole %, more
preferably 30-50 mole % of the sum of imide groups and amide groups.
Percentages smaller than 10 mole % lead to small adhesion but percentages
greater than 90 mole % result in a large **water absorption** rate.

DEPR:
The heat-resistant adhesive according to the present invention can be
synthesized principally from (A) a diamine or (A') a diisocyanate and (B) an
acid anhydride and/or (C) a dicarboxylic acid or an amide-forming derivative
thereof. The heat-resistant adhesive can be easily produced by combining the
above reactants and also adjusting their reaction ratio, reaction conditions
and molecular weight, optionally adding additives while selecting their types
and optionally adding an additional resin such as an epoxy resin in such a way
that the resulting heat-resistant adhesive has the prescribed properties
described above, namely, a coming-out length of not more than 2 mm a **water**

absorption rate of not more than 3 wt. % and preferably a
glass transition
temperature of at least 200.degree. C.

DEPR:
In this case, it has been found that even if a
heat-resistant adhesive has Tg
lower than 200.degree. C., mixing of an additional resin
such as an epoxy
resin and one or more of the below-described additives,
such as a coupling
agent, make it possible to adjust its **water absorption** rate
and coming-out
length within the respective ranges specified in the
present invention.

DEPR:
No particular limitation is imposed on the epoxy resin
which can be mixed with
a specific heat-resistant polyimide adhesive of the present
invention, in so
far as it has at least 2 epoxy groups on average per
molecule. Examples of
such an epoxy resin include the **glycidyl ether** of bisphenol
A, the **glycidyl**
ether of bisphenol F, phenolnovolak type epoxy resins,
polyglycidyl esters of
polyhydric alcohols, polyglycidyl esters of polybasic
acids, alicylic epoxy
resins and hydantoin epoxy resins.

DEPR:
When the heat-resistant adhesive according to the present
invention is used as
a composite adhesive sheet by coating it on a base film (or
sheet), the
composite adhesive sheet can be obtained by coating a
heat-resistant adhesive
having a **water absorption** rate of not more than 3 wt. % and
a coming-out length
of not more than 2 mm and, preferably, a glass transition
temperature of at
least 200.degree. C. or a varnish thereof on both surfaces
of a heat-resistant
film, preferably a surface-treated heat-resistant film.

DEPR:
The heat-resistant film has a glass transition temperature

(Tg) which is higher
than that (Tg) of the heat-resistant adhesive according to
the present
invention and is preferably at least 200.degree. C., more
preferably
250.degree. C. or higher. The heat-resistant film has a
water absorption rate
of not more than 3 wt. %, preferably 2 wt. % or lower.

DEPR:
Accordingly, the heat-resistant film employed in this
invention may preferably
be a polyimide film in view of Tg, **water absorption** rate
and coefficient of
thermal expansion. Particularly preferred is a film
equipped with the physical
properties that the Tg is at least 250.degree. C., the
water absorption rate
is 2 wt. % or less and a coefficient of thermal expansion
of 3.times.10.sup.-5
/.degree. C. or lower.

DEPR:
The film was immersed in water of 25.degree. C. for 24
hours. As a result, it
was found to have a **water absorption** rate of 0.3 wt. %.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 1.21 dl/g,
Tg of 268.degree. C., a thermal decomposition point of
410.degree. C., a
water absorption rate of 0.7 wt. % and a coming-out length
of 0.01 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.48 dl/g,
Tg of 300.degree. C., a thermal decomposition temperature
of 405.degree. C.,
a **water absorption** rate of 1.0 wt. % and a coming-out
length of 0.5 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.61 dl/g,
Tg of 275.degree. C., a thermal decomposition temperature
of 415.degree. C.,

a **water absorption** rate of 0.5 wt. % and a coming-out
length of 1.5 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.62 dug, Tg
of 255.degree. C., a thermal decomposition temperature of
440.degree. C., and
a **water absorption** rate of 1.2 wt. % and a coming-out
length of 0.2 mm.

DEPR:
The polyamide so obtained was found to have a reduced
viscosity of 0.45 dl/g,
Tg of 219.degree. C., a thermal decomposition temperature
of 425.degree. C.,
a **water absorption** rate of 2.3 wt. % and a coming-out
length of 2.4 mm.

DEPR:
The composite film was found to have Tg of 255.degree. C.,
a **water absorption**
rate of 0.6 wt. % and a coming-out length of 1.5 mm.

DEPR:
In 20 g of DMF, 1.74 g (7 mmole) g of
4,4'-diaminodiphenylsulfone (DDS) and
1.23 g (3 mmole) of BAPP were dissolved, followed by the
addition of 2.02 g (20
mmole) of triethylamine. While being cooled below
5.degree. C., the resulting
solution was added with 2.03 g (10 mmole) of isophthaloyl
chloride in portions.
They were reacted for 5 hours below 5.degree. C. As in
Example 1, a polyamide
was obtained in the form of powder. The polyamide so
obtained was found to
have a reduced viscosity of 0.88 dl/g, Tg of 260.degree.
C., a thermal
decomposition temperature of 435.degree. C., a **water
absorption** rate of 2.5
wt. % and a coming-out length of 0.2 mm.

DEPR:
The composite film was found to have Tg of 260.degree. C.,
a **water absorption**
rate of 1.1 wt. % and a coming-out length of 0.5 mm.

DEPR:
The polyamide-imide so obtained was found to have a reduced
viscosity of 1.15
dl/g, Tg of 258.degree. C., a thermal decomposition
temperature of 385.degree.
C., a **water absorption** rate of 1.0 wt. % and a coming-out
length of 0.02 mm.

DEPR:
In a similar manner to Example 1 except that 5.76 g (10
mmole) of BABT, 2.74 9
(7.5 mmole) of IPDDM, 0.41 g (1.0 mmole) of BAPP and 1.26 g
(1.5 mmole) of
"X-22-161AS" were used instead, a polyimide was obtained in
the form of powder.
The polyimide so obtained was found to have a reduced
viscosity of 0.65 dl/g,
Tg of 226.degree. C., a thermal decomposition temperature
of 396.degree. C.,
a **water absorption** rate of 0.3 wt. % and a coming-out
length of 1.7 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.87 dl/g,
Tg of 270.degree. C., a thermal decomposition temperature
of 520.degree. C.,
a **water absorption** rate of 2.3 wt. % and a coming-out
length of 0.01 mm.

DEPR:
The polyamide-imide so obtained was found to have a reduced
viscosity of 0.57
dl/g, Tg of 185.degree. C., a thermal decomposition
temperature of 420.degree.
C., a **water absorption** rate of 0.13 wt. % and a coming-out
length of 0.8 mm.

DEPR:
A varnish which had been obtained by dissolving 100 g of
the polyamide-imide
powder and 3 g of .gamma.-glycidoxypropyltrimethoxysilane
in 400 g of DMF was
coated on one surface of a polyimide film ("UPILEX S",
trade name), followed by
drying at 100.degree. C. for 10 minutes. The other
surface of the polyimide
film was also coated with the varnish similarly, followed

by drying at
250.degree. C. for 10 minutes, whereby a composite sheet
was obtained. The
composite sheet so obtained was found to have an adhesive
strength of 1.6 kN/m
with a 42 alloy sheet. The adhesive layers were found to
have Tg of
185.degree. C., a **water absorption** rate of 1.3 wt. % and a
coming-out length
of 0.2 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.65 dl/g,
Tg of 170.degree. C., a thermal decomposition temperature
of 390.degree. C.,
a **water absorption** rate of 1.0 wt. % and a coming-out
length of 1.8 mm.

DEPR:
Using a varnish obtained by dissolving 100 g of the
polyimide powder and 5 g of
.gamma.-glycidoxypropyl-methyldiethoxysilane in 400 g of
DMF, a composite sheet
was obtained as in Example 13. The composite sheet had an
adhesive strength of
1.3 kN/m with a 42 alloy sheet. In addition, the adhesive
layers were found to
have Tg of 172.degree. C., a **water absorption** rate of 1.0
wt. % and a
coming-out length of 1.8 mm.

DEPR:
The polyamide-imide so obtained was found to have a reduced
viscosity of 0.85
dl/g, Tg of 190.degree. C., a thermal decomposition
temperature of 395.degree.
C., a **water absorption** rate of 0.1 wt. % and a coming-out
length of 0.6 mm.

DEPR:
A varnish obtained by dissolving 100 g of the
polyamide-imide powder and 10 g
of .gamma.-glycidoxypropyl-methyldiethoxysilane in 400 g of
NMP was coated on
both surfaces of a polyimide film ("UPILEX S", trade name).
 The varnish so
coated was dried at 100.degree. C. for 10 minutes and then

at 275.degree. C.
for 10 minutes, whereby a composite sheet was obtained.
The composite sheet
was found to have an adhesive strength of 1.4 kN/m with a
42 alloy sheet. In
addition, the adhesive layers were found to have Tg of
191.degree. C., a **water**
absorption rate of 1.1 wt. % and a coming-out length of 0.2
mm.

DEPR:
The polyamide so obtained was found to have a reduced
viscosity of 0.45 dl/g,
Tg of 280.degree. C., a thermal decomposition temperature
of 430.degree. C.,
a **water absorption** rate of 3.5 wt. % and a coming-out
length of 1.2 mm.

DEPR:
In a similar manner to Example 4, polyimide powder having a
reduced viscosity
of 0.35 dl/g was obtained. The polyimide so obtained was
found to have Tg of
275.degree. C., a thermal decomposition temperature of
410.degree. C., a
water absorption rate of 0.6 wt. % and a coming-out length
of 3.4 mm.

DEPR:
The polyimide so obtained was found to have a reduced
viscosity of 0.44 dl/g,
Tg of 187.degree. C., a thermal decomposition temperature
of 465.degree. C.,
a **water absorption** rate of 1.1 wt. % and a coming-out
length of 2.2 mm.

CLPW:
said adhesive member is made of polyimide or polyamide and
includes a
heat-resistant adhesive having a coming-out length of not
more than 2 mm and a
water absorption rate of not more than 3 wt. % wherein

DOCUMENT-IDENTIFIER: US 5319005 A
TITLE: Epoxy resin molding material for sealing of
electronic component

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ASZZ:
Hitachi Chemical Co., Ltd.

BSPR:
As to the component (A) to be used in the present
invention, namely the epoxy
resin having at least two epoxy groups per molecule, any
one used generally in
known epoxy resin molding materials for sealing of
electronic components can be
used. Typical examples are epoxidation products of novolak
resins of phenols
and aldehydes, such as phenol novolak epoxy resin and
o-cresol novolak epoxy
resin; diglycidyl ether epoxy resins which are obtainable
from the reaction of
phenols, such as bisphenol A, bisphenol F, bisphenol S and
alkyl-substituted
biphenol, and epichlorohydrin; glycidylamine epoxy resins
which are obtainable
from the reaction of polyamines, such as
diaminodiphenylmethane and isocyanuric
acid, and epichlorohydrin; linear aliphatic epoxy resins
and alicyclic epoxy
resins which are obtainable by oxidation of olefinic bonds
with peracids, such
as peracetic acid; and brominated epoxy resins thereof.

BSPR:
Among various kinds of epoxy resins which may be used, a
biphenyl structure
epoxy resin represented by the following structural formula
##STR1## has a
particularly excellent soldering resistance, and it is
desirable that the epoxy
resin in the epoxy resin molding material of the present
invention contains at
least 60% by weight of the biphenyl structure epoxy resin
based on total of the

epoxy resin used. By the use of the epoxy resin containing 60% by weight or
more of the biphenyl structure epoxy resin, the low **water absorption** and the
adhesive properties of the molding material of the present invention is highly
improved, thereby providing very high soldering resistance. This biphenyl
structure epoxy resin can be obtained by the epoxidation of
4,4'-dihydroxy-3,3',5,5'-tetramethylbiphenyl with epichlorohydrin.

BSPR:
Among various kinds of the phenolic compounds which may be used as the
component (B), a phenol resin represented by the following structural formula
##STR2## has a particularly excellent soldering resistance, and it is
preferable that the phenolic compound in the epoxy resin molding material of
the present invention contains at least 60% by weight of the phenol resin based
on total of the phenolic compound used. By the use of the phenolic compound
containing 60% by weight or more of the phenol resin, the low **water absorption**
and the adhesive properties of the molding material of the present invention is
highly improved, thereby providing high soldering resistance. Using the
above-described biphenyl structure epoxy resin and this phenol resin in
combination further improves the soldering resistance of the epoxy resin
molding material of the present invention.

BSPR:
The epoxy resin molding material for sealing of electronic components of the
present invention further contains an inorganic filler as a component (D).
Typical examples of the inorganic filler are crushed or spherical (beaded)
powder of fused silica, crystalline silica, alumina, zircon, calcium silicate,
calcium carbonate, silicon carbide, silicon nitride, beryllia, zirconia; single

crystal fiber of potassium titanate, silicon carbide, silicon nitride, alumina;
and glass fiber. These inorganic fillers may be used individually or in
combination of two or more of them. In order to decrease the **water absorption**
and coefficient of thermal expansion and to increase the strength, the amount
of the inorganic fillers added is preferably at least 70% by volume, more
preferably from 70 to 80% by volume of the total of the epoxy resin molding
material. Among the inorganic fillers described above, the preferred are fused
silica from the viewpoint of decreasing the coefficient of thermal expansion,
and alumina from the view point of high thermal conductivity. The shape of the
inorganic fillers is preferably spherical for purposes of increasing the
flowability of the molding materials and of preventing the abrasion of the
molds during molding.

DETL:
TABLE 2

Properties of molding material	Example Nos.					Comparative Example Nos.				
	1	2	3	4	5	1	2	3	4	5
Spiral flow (in)	30	52	33	35	33	35	41	34	35	38
Appearance of molded product	good	good	good	good	good	good	good	bad clouded	clouded	clouded
Critical surface tension (mN/m)	30	30	30	30	30	32	32	26	27	27
Marking strength (the number of times)	>30	>30	>30	>30	>30	>30	>30	5	17	20
Adhering strength (N/m) Room temperature	420	630	690	850	860	400	840	520	380	750
215.degree. C.	150	100	140	160	160	150	170	110	130	130
Water absorption (wt. %) 24 hours	0.15	0.11	0.08	0.07	0.07	0.12	0.06	0.07	0.15	0.07
72 hours	0.21	0.18	0.14	0.11	0.11	0.18	0.10	0.12	0.21	0.12
Thermal shock resistance	>2000	>2000	>2000	>2000	>2000	1200	1800	>2000	>2000	>2000

(50%-crack-occuring
cycles) Soldering resistance (h) 72 96 120 168 168 72 168
72 72 168
(humidifying time taken to cause crack) Moisture
resistance (h) >1000 >1000
>1000 >1000 >1000 200 500 >1000 >1000 >1000 (time
taken to cause
50%-failure)

DETL:
TABLE 3-2

85.degree. C. Percentage of weight change of **Water
absorption** JIS-K-6911
Analytical balance 85% RH molded products (.phi.50
.times. t3)

Marking strength IC: standard DIP 16 pins (Marking was
done on a mirror
finished surface.) Marking: thermosetting ink *,
150.degree. C., one hour
curing Evaluation: The number of times of rubbing with a
cotton applicator
until the mark which had been subjected to dipping in
trichloroethylene for
10 minutes became blurred. Thermal shock resistance IC:
flat package, 19
.times. 14 .times. 2.7 (mm), 54 pins, alloy 42 lead frame,
chip 6 .times. 6
.times. 0.4 (mm) (cracking of IC packages) Molding:
180.degree. C., 70
kg/cm.sup.2, 90 sec + 180.degree. C., 5 hours Test:
150.degree. C. (oil) /
liquid nitrogen, 2 minutes, respectively (one cycle)
Evaluation: The presence
of cracks in 20 packages was observed by microscopic
observation. Soldering
resistance IC: flat package, 19 .times. 14 .times. 2.7
(mm), 54 pins, alloy
42 lead frame, chip 6 .times. 6 .times. 0.4 (mm) (cracking
of IC packages)
Molding: 180.degree. C., 70 kg/cm.sup.2, 90 sec +
180.degree. C., 5 hours
Test: After the IC packages were humidified under the
conditions of 85.degree.
C., 85% RH, a VPS ** was carried out at 215.degree. C. for
90 seconds.

Evaluation: The presence of cracks in 20 packages was observed by microscopic observation. Moisture resistance IC: flat package, 19 .times. 14 .times. 2.7 (mm), 54 pins, alloy 42 lead frame, chip 6 .times. 6 .times. 0.4 (mm) (corrosion of aluminum Chip: the sample chips were produced by forming an oxidated layer of 1 .mu.m thick on pattern in IC chips) silicon substrates and providing on the oxidated layer an aluminum pattern of 10 .mu.m in line width, 1 .mu.m thick. Test: humidifying at 85.degree. C., 85% RH, 72 hours, VPS treatment at 215.degree. C. for 90 seconds, and exposure to 2 atm PCT for a predetermined time, in this order. Evaluation: Electric failure due to corrosion of aluminum pattern was checked.

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7261 (silver) produced by MarkemAsiatic Co., Inc. ** Vapor Phase Soldering

DOCUMENT-IDENTIFIER: US 5238730 A
TITLE: Electrical laminate with dibasic acid-modified epoxy
(meth)acrylate

---------- KWIC ---------

ASZZ:
Hitachi Chemical Company, Ltd.

BSPR:
In Japanese Patent Application Publication No. 60-17340
disclosed is a method
wherein a resin obtained by reacting a halogenized
bisphenol A diglycidyl ether
with a dimer acid is used as the flame retardant for
thermosetting resins, and
in Japanese Patent Application Publication open No.
60-45061 disclosed is a
method of using a resin varnish consisting of a
dicyclopentadiene polyester
resin, an acrylic ester of diglycidyl ether or **glycidyl
ester** through a dibasic
acid of 4 to 36 carbon atoms, and an organic peroxide.
However, these
conventional methods failed in providing laminates
satisfying all requirements
concurrently, that is, good flame resistance, improvement
of the punching
quality at low temperature, moisture resistance, chemical
resistance, and
excellent electrical properties.

DEPR:
Also, the other flame retardants may be added to these
resins for impregnating
base materials, at need. Typical examples of such flame
retardants include
halogen-containing flame retardants such as
hexabromocyclododecane,
hexabromobenzene, polybrominated biphenyl ether,
heptabromotoluene,
2,4,6-tribromophenol methacrylate, 2,4,6-tribromophenol
glycidyl ether,
brominated epoxy resins; and phosphoric esters such as
triphenyl phosphate,

tricresyl phosphate, and trimethyl phosphate. The
particularly preferred flame
retardants are those which can be polymerized with the
thermosetting resin
compositions of the present invention.

DEPR:
A mixture of 100 parts of tetrabromobisphenol A **glycidyl
ether** (epoxy
equivalent: 395 to 410), 35.7 parts of dimer acid, 1.3
parts of
benzyldimethylamine, 62 parts of styrene, and 0.05 parts of
hydroquinone was
reacted at 90.degree. to 100.degree. C. until the acid
value dropped not more
than 6, and reaction was then continued by adding 9 parts
of methacrylic acid,
to obtain a dimer acid modified epoxy methacrylate resin
having an acid value
of 2.3 (resin (7)).

DETL:
TABLE 1

Comparative Comparative Example 1 Example 2 Example 3
Example 4 Example 5
Example 1 Example

2
Water absorption (%)   0.45 0.46 0.48 0.45 0.41 0.41 0.49
E-24/50 + D-24/23
Insulation resistance (.OMEGA.) 1.2 .times. 10.sup.10 1.1
.times. 10.sup.10
5.0 .times. 10.sup.9 5.5 .times. 10.sup.8 6.1 .times.
10.sup.8 2.0 .times.
10.sup.11 3.2 .times. 10.sup.8 (D-2/100) Soldering heat
resistance 60 57
62 50 57 90 40 260.degree. C. (second) Flame resistance
V-0 V-0 V-0 V-1 V-1
V-0 HB Dielectric constant A 3.9 3.8 3.9 4.2 4.0 3.7 4.4
(1 MHz) D-48/50
4.6 4.6 4.5 4.8 4.6 4.3 5.0 Dielectric dissipation A
0.0240 0.0242 0.241
0.0310 0.0300 0.0260 0.0340 factor (1 MHz) D-48/50 0.0280
 0.0288 0.283
0.0450 0.0420 0.0289 0.0450 Punching quality 20.degree.
C. .DELTA. .DELTA.
.DELTA. .circleincircle..about..DELTA. .DELTA. X

.DELTA..about.X 40.degree.
C. .circleincircle. .circleincircle.
.circleincircle..about..DELTA.
.circleincircle. .circleincircle. .DELTA..about.X
.circleincircle..abo
ut..DELTA. 60.degree. C. .circleincircle.
.circleincircle. .circleincircle.
.circleincircle. .circleincircle. .DELTA.
.circleincircle. 80.degree. C.
.circleincircle. .circleincircle. .circleincircle.
.circleincircle..about..DELTA.
.circleincircle..about..DELTA.
.circleincircle..about..DEL TA. .circleincircle.

Test
methods Flame resistance: UL268 & 492 Punching quality:
ASTM D61744 the
others: JIS C 6481 D; dipping E; drying A; normal
condition 24/50; measurement
after standing at 50.degree. C. for 24 hours